

Figure 1

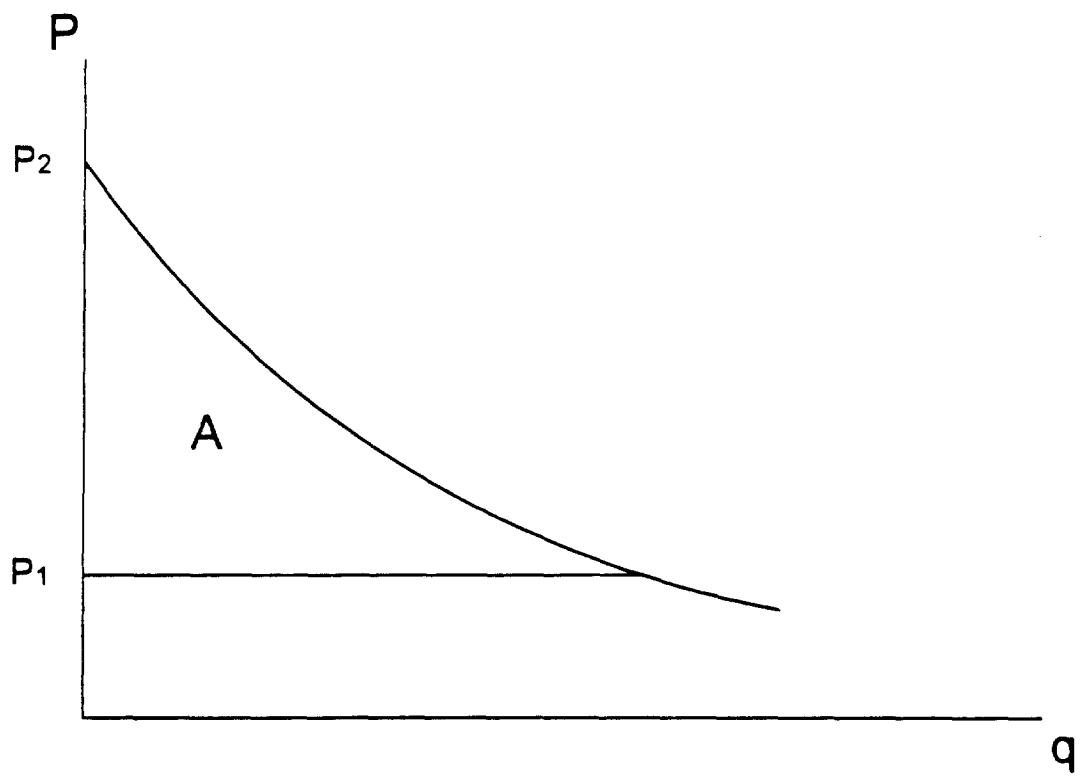
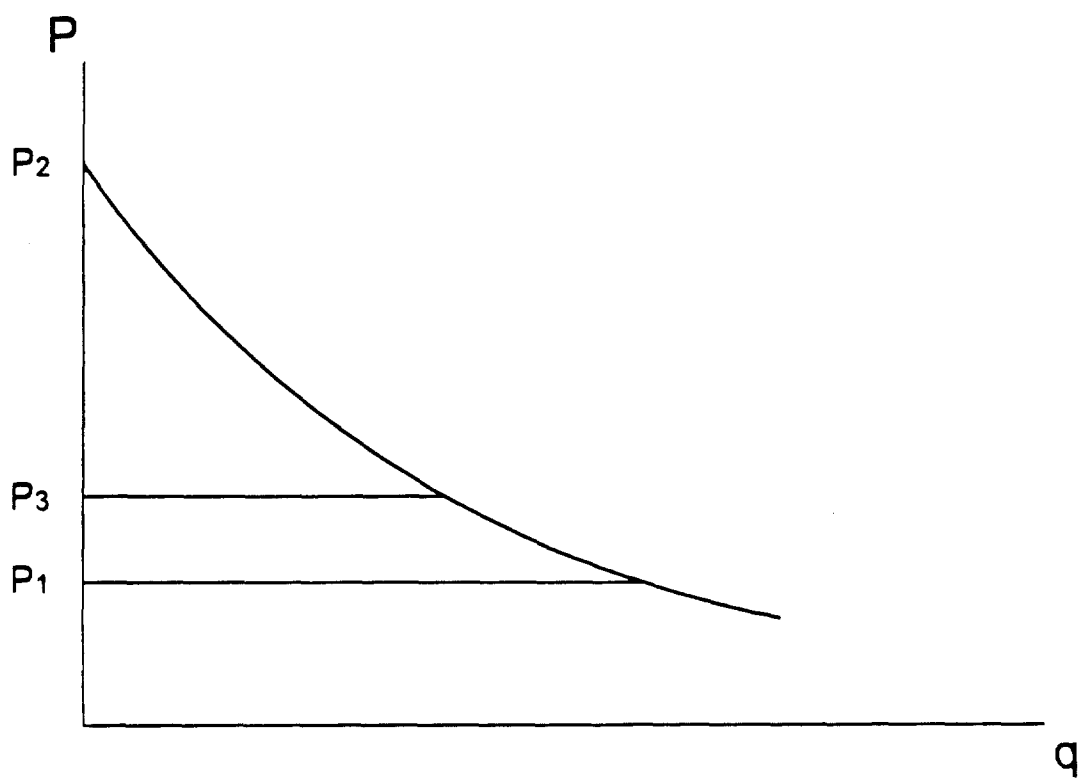


Figure 2



Appendix A

(1) Formulae for Consumer Welfare Calculations

To estimate the overall effect on consumer welfare, we use an exact consumers surplus approach using the expenditure function for the log linear demand curve. 1. First, we use the expenditure function calculated in Hausman (1981), equation (23)³⁸:

$$e(p, \bar{u}) = [(1-\delta) (\bar{u} + Ap^{1+\alpha}/(1+\alpha))]^{1/(1-\delta)} \quad (1)$$

where A is the intercept of the demand curve, α is the price elasticity, and δ is the income elasticity estimate. The compensating variation is calculated from equation (1) where y is income:

$$CV = \left\{ \frac{(1-\delta)}{(1+\alpha)} y^{-\delta} [p_1 x_1 - p_0 x_0] + y^{(1-\delta)} \right\}^{1/(1-\delta)} - y \quad (2)$$

The compensating variation is used to calculate the effect of price changes on consumer welfare.

For the case of a new good, the expenditure function from equation (1) is used to calculate the compensated (Hicksian) demand curve, and the "reservation" or "virtual" price is calculated; see Hausman (1994).³⁹ This price can be used in the expenditure function of equation (1) to calculate consumer's surplus from introduction of the new good.

³⁸J. Hausman, "Exact Consumer's Surplus and Deadweight Loss," American Economic Review 71 (1981).

³⁹J. Hausman, "Valuation of New Goods Under Perfect and Imperfect Competition," MIT Working Paper (June 1994).

(2) Econometric Results for Voice Messaging

Data on demand for BOC voice messaging was available for 14 states over a 4 year period, 1991-1994. A log-log demand specification, consistent with the consumer welfare methodology developed above, was used. Fixed effects for each state were included, as well as state specific time trends to allow for the growth in demand of voice messaging as potential customers become increasingly aware of the service. To account for potential joint endogeneity of demand and price, we use the Hausman-Taylor (1981) approach of prices from different markets as instruments for prices in a given market.⁴⁰

The model fits quite well, with the standard error estimated to be 0.042.⁴¹ The estimated price elasticity is -1.10, with an asymptotic standard error of 0.31. Thus, the estimated t-statistic is 3.55, which indicates quite precise estimation.

⁴⁰J. Hausman and W. Taylor, "Panel Data and Unobservable Individual Effects," Econometrica (1981).

⁴¹In terms of an R^2 measure for an OLS regression, the R^2 would be 0.999, although this measure is not appropriate for an instrumental variable estimator.

March 1995

JERRY A. HAUSMAN
Massachusetts Institute of Technology
Department of Economics
Building E52-271A
Cambridge 02139
(617) 253-3644

EDUCATION:

OXFORD UNIVERSITY

D. Phil. 1973 (Ph.D)

B. Phil. 1972

BROWN UNIVERSITY

A.B. (Summa Cum Laude), 1968

THESIS: "A Theoretical and Empirical Study of Vintage Investment and Production in Great Britain,"
Oxford University, 1973.

FELLOWSHIPS, HONORS AND AWARDS:

Phi Beta Kappa

Marshall Scholar at Oxford, 1970-1972

Scholarship at Nuffield College, Oxford, 1971-1972

Fellow of Econometric Society, 1979.

Frisch Medal of the Econometric Society, 1980

Fisher-Schultz Lecture for the Econometric Society, 1982

John Bates Clark Award of the American Economic Association, 1985

Jacob Marschak Lecture for the Econometric Society, 1988

American Academy of Arts and Sciences, 1991.

EMPLOYMENT:

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

1992- John and Jennie S. MacDonald Professor

1979- Professor, Department of Economics

1976-79 Associate Professor, Department of Economics

1973-76 Assistant Professor, Department of Economics

1972-73 Visiting Scholar, Department of Economics

VISITING APPOINTMENTS:

1986-87 Visiting Professor, Harvard Business School

1982-83 Visiting Professor, Harvard University Department of Economics

U.S. ARMY, ANCHORAGE, ALASKA

1968-70 Corps of Engineers

PROFESSIONAL ACTIVITIES:

Associate Editor, Bell Journal of Economics, 1974-1983
Associate Editor, Rand Journal of Economics, 1984-1988
Associate Editor, Econometrica, 1978-1987
Reviewer, Mathematical Reviews, 1978-1980
American Editor, Review of Economic Studies, 1979-82
Associate Editor, Journal of Public Economics, 1982-
Associate Editor, Journal of Applied Econometrics, 1985-1993
Member of MIT Center for Energy and Environmental Policy Research, 1973-
Research Associate, National Bureau of Economic Research, 1979-
Member, American Statistical Association Committee on Energy Statistics, 1981-1984
Special Witness (Master) for the Honorable John R. Bartels, U.S. District Court for the Eastern District of New York in Carter vs. Newsday, Inc., 1981-82
Member of Governor's Advisory Council (Massachusetts) for Revenue and Taxation, 1984-1992
Member, Committee on National Statistics, 1985-1990
Member, National Academy of Social Insurance, 1990-
Member, Committee to Revise U.S. Trade Statistics 1990-1992
Director, MIT Telecommunications Economics Research Program, 1988-
Board of Directors, Theseus Institute, France Telecom University, 1988-
Member, Conference on Income and Wealth, National Bureau of Economic Research, 1992-

PUBLICATIONS:

I. Econometrics

- "Minimum Mean Square Estimators and Robust Regression," Oxford Bulletin of Statistics, April 1974.
- "Minimum Distance and Maximum Likelihood Estimation of Structural Models in Econometrics," delivered at the European Econometric Congress, Grenoble: August 1974.
- "Full-Information Instrumental Variable Estimation of Simultaneous Equation Models," Annals of Economic and Social Measurement, October 1974.
- "Estimation and Inference in Nonlinear Structural Models," Annals of Economic and Social Measurement, with E. Berndt, R.E. Hall, and B.H. Hall, October 1974.
- "An Instrumental Variable Approach to Full-Information Estimators in Linear and Certain Nonlinear Econometric Models," Econometrica, May 1975.
- "Simultaneous Equations with Errors in Variables," delivered at Winter Econometric Meetings, San Francisco: December 1974; published in Journal of Econometrics 5, 1977, pp. 389-401.
- "Social Experimentation, Truncated Distributions, and Efficient Estimation," delivered at the World Econometric Congress, Toronto: August 1975; Econometrica, with D. Wise, June 1977.
- "A Conditional Probit Model for Qualitative Choice," delivered at World Econometric Congress, Toronto: August 1975; MIT Working Paper 173, April 1976; Econometrica, with D. Wise, March 1978.

PUBLICATIONS cont.:

- "Specification Tests in Econometrics," MIT Working Paper 185, June 1976; Econometrica, 1978.
- "Non-Random Missing Data," with A.M. Spence, MIT Working Paper 200, May 1977.
- "Attrition Bias in Experimental and Panel Data: The Gary Income Maintenance Experiment," with D. Wise, J.F. Kennedy School Working Paper, May 1977; Econometrica, January 1979.
- "Missing Data and Self Selection in Large Panels," with Z. Griliches and B.H. Hall, Harvard Economics Department Working Paper, August 1977; delivered at INSEE conference on Panel Data, Paris: August 1977; Annales de l'INSEE, April 1978.
- "Stratification on Endogenous Variables and Estimation," with D. Wise, J.F. Kennedy School Working Paper, January 1978; delivered at CME Conference, April 1978; in The Analysis of Discrete Economic Data, ed. C. Manski and D. McFadden, MIT Press, 1981.
- "Les models probit de choix qualitatifs," ("Alternative Conditional Probit Specifications for qualitative Choice.") (English Version), September 1977; EPRI report on discrete choice models, presented at INSEE Seminar, Paris: May 1978; Cahiers du Seminar d'Econometrie, 1980.
- "The Econometrics of Labor Supply on Convex Budget Sets," Economic Letters, 1979.
- "Panel Data and Unobservable Individual Effects," with W. Taylor, MIT Working Paper 225; Econometrica 49, November 1981.
- "Comparing Specification Tests and Classical Tests," with W. Taylor, August 1980, Economic Letters, 1981.
- "The Effect of Time on Economic Experiments," invited paper at Fifth World Econometrics Conference, August 1980; in Advances in Econometrics, ed. W. Hildebrand, Cambridge University Press, 1982.
- "Sample Design Considerations for the Vermont TOD Use Survey," with John Trimble, Journal of Public Use Data, 9, 1981.
- "Identification in Simultaneous Equations Systems with Covariance Restrictions: An Instrumental Variable Interpretation," with W. Taylor, December 1980; Econometrica, 1983.
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- "Specification Tests for the Multinomial Logit Model," with D. McFadden, October 1981; Econometrica, 1984.
- "Econometric Models for Count Data with an Application to the Patents R&D Relationship," with Z. Griliches and B. Hall, NBER Working Paper, August 1981; Econometrica, 1984.
- "The Econometrics of Nonlinear Budget Sets," Fisher-Shultz lecture for the Econometric Society, Dublin: 1982; Econometrica, 1985.
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- "Semiparametric Identification and Estimation of Polynomial Errors in Variables Models," with W. Newey, J. Powell and H. Ichimura, 1986, Journal of Econometrics, 1991.
- "Flexible Parametric Estimation of Duration and Competing Risk Models," with A. Han, November 1986, revised January 1989, Journal of Applied Econometrics, 1990.
- "Consistent Estimation of Nonlinear Errors in Variables Models with Few Measurements," with W. Newey and J. Powell, 1987.
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- "Optimal Revision and Seasonal Adjustment of Updated Data: Application to Housing Starts," with M. Watson, Journal of the American Statistical Association Proceedings, 1991.
- "Seasonal Adjustment of Trade Data," with R. Judson and M. Watson, ed. R. Baldwin, Behind the Numbers: U.S. Trade in the World Economy, 1992.
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- "The Effect of Wages, Taxes, and Fixed Costs on Women's Labor Force Participation," March 1979; presented at SSRN-NBER Conference on Taxation, Cambridge, England: June 1979; Journal of Public Economics, October 1980.
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- "Income and Payroll Tax Policy and Labor Supply," presented at St. Louis Fed. conference, October 1980; in The Supply Side Effects of Economic Policy, ed. G. Burtless, St. Louis: 1981.
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- "Household Behavior and the Tax Reform Act of 1986," with J. Poterba, October 1986; Journal of Economic Perspectives, 1987, also published in French in Annales D'Economie et de Statistique, 1988.
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III. Applied Micro Models

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- "Assessment and Validation of Energy Models," presented at EIA-NBS conference on Energy Models, May 1980; in Validation and Assessment of Energy Models, ed. S. Gass, Washington: Department of Commerce, 1981.
- "Exact Consumer Surplus and Deadweight Loss," working paper 1979, American Economic Review, 71, 1981.
- "Appliance Purchase and Usage Adaptation to a Permanent Time of Day Electricity Rate Schedule," with J. Trimble, August 1983; Journal of Econometrics, 1984.

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- "Information Costs, Competition and Collective Ratemaking in the Motor Carrier Industry," presented at Conference On Consensual Decision Making, American University, August 1982; American University Law Review, 1983.
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- "The Demand for Optional Local Measured Telephone Service," in Adjusting to Regulatory, Pricing and Marketing Realities, East Lansing: 1983.
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- "Residential End-Use Load Shape Estimation from Whole-House Metered Data," IEEE Transactions on Power Systems, 1988 (with I. Schick, P. Vsoro, and M. Ruane).
- "Competition in Telecommunications for Large Users in New York," with H. Ware and T. Tardiff, Telecommunications in a Competitive Environment, 1989.
- "Innovation and International Trade Policy," Oxford Review of Economic Policy, 1988 (with J. MacKie-Mason).
- "The Evolution of the Central Office Switch Industry," with W. E. Kohlberg, 1987; in ed. S. Bradley and J. Hausman, Future Competition in Telecommunications, 1989.
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- "Global Competition and Telecommunications," in Bradley, et al., ed., Globalization, Technology and Competition, 1993.
- "The Bell Operating Companies and AT&T Venture Abroad and British Telecom and Others Come to the US," presented at Harvard Business Conference on International Telecommunications, 1991, in Bradley, et al., ed., Globalization, Technology and Competition, 1993.
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- "The Effects of the Breakup of AT&T on Telephone Penetration in the US," with T. Tardiff and A. Belinfante, American Economic Review, 1993.
- "Proliferation of Networks in Telecommunications," ed. D. Alexander and W. Sichel, Networks, Infrastructure, and the New Task for Regulation, University of Michigan Press, forthcoming 1995.
- "The Effect of Superstars in the NBA: Economic Value and Policy," with G. Leonard, mimeo May 1994.
- "Valuation of New Goods Under Perfect and Imperfect Competition," MIT Working Paper, June, 1994.
- "Cellular Telephone: Competition and Regulation," mimeo, June 1994.
- "Competition in Long Distance and Equipment Markets: Effects of the MFJ," 1994, forthcoming in Journal of Managerial and Decision Economics, 1995.
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JOINT REPORTS, TESTIMONY, AND BOOKS:

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- "The FEA's Project Independence Report: Testimony before Joint Economic Committee," U.S. Congress, March 18, 1975.
- "The FEA's Project Independence Report: An Analytical Assessment and Evaluation," NSF Report, June 1975.
- "Energy Demand in the ERDA Plan," with D. Wood, Energy Laboratory Report, August 1975.

JOINT REPORTS, TESTIMONY, AND BOOKS cont.:

"A Note on Computational Simplifications and Extensions of the Conditional Probit Model," EPRI report on choice models, September 1977.

"Labor Supply Response of Males to a Negative Income Tax," Testimony for U.S. Senate Finance Subcommittee on Public Assistance, November 22, 1978.

"Appliance Choice with Time of Day Pricing," Energy Laboratory Report, January 1980.

"Discrete Choice Models with Uncertain Attributes," Oak Ridge National Laboratories Report, January 1980.

"Individual Savings Behavior," with P. Diamond, Report to the National Commission on Social Security, May 1980.

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"A Review of IFFS," Report to the Energy Information Agency, February 1982.

"A Model of Heating System and Appliance Choice," with J. Berkovec and J. Rust, December 1983.

"Labor Force Behavior of Older Men After Involuntary Job Loss," with L. Paquette, Report to Department of Health and Human Services, December 1985.

"Pollution and Work Days Lost," with D. Wise and B. Ostrow, NBER Working Paper, January 1984; Revised 1985.

"Demand for Interstate Long Distance Telephone Service," with A. Jafee and T. Tardiff, November 1985.

"Competition in the Information Market 1990", August 1990.

The Choice and Utilization of Energy Using Durables, ed. J. Hausman, Palo Alto: EPRI, 1981.

Social Experimentation, ed. J. Hausman and D. Wise, Chicago: 1985.

Future Competition in Telecommunications, ed. S. Bradley and J. Hausman, Harvard: 1989.

Contingent Valuation: A Critical Appraisal, ed. J. Hausman, North Holland, 1993.

Globalization, Technology and Competition, ed. S. Bradley, J. Hausman, R. Nolan, Harvard 1993.

"The Welfare Cost to the US Economy of Regulatory Restriction in Telecommunications," January 1995.

Economic Impact of Deregulating U.S. Communications Industries, The WEFA Group, Burlington, MA, February 1995.

NATIONAL ECONOMIC
RESEARCH ASSOCIATES

1800 M STREET, NW, WASHINGTON, DC 20036
TEL: 202 466 3510 FAX: 202 466 3605

nera

AN AMERICAN COMPANY

TIMOTHY J. TARDIFF

BUSINESS ADDRESS

National Economic Research Associates, Inc.
One Main Street
Cambridge, Massachusetts 02142
(617) 621-0444

Dr. Tardiff received a B.S. with honors in Mathematics from the California Institute of Technology in Pasadena and a Ph.D. degree in Social Science from the University of California, Irvine, under a National Science Foundation Pre-doctoral Fellowship and an NSF Grant for Improving Dissertation Research in the Social Sciences.

Dr. Tardiff joined the faculties of the Department of Civil Engineering and the Division of Environmental Studies at the University of California, Davis. He taught undergraduate and graduate level courses in transportation and environmental policy analysis. His research included applications of econometric models of consumer choice to transportation planning problems. Dr. Tardiff's research was funded by the National Science Foundation, the Institute of Transportation Studies and the California Department of Transportation.

Prior to joining NERA, Dr. Tardiff's work included transportation, energy, public utility and telephone industry projects for the U.S. Departments of Transportation and Energy, the California Energy Commission, and several telephone and electric utilities.

Since joining NERA, he has evaluated pricing policies for increasingly competitive telecommunications markets, including appropriate mechanisms for pricing access services to competitors; studied actual and potential competition for services provided by telephone operating companies; analyzed the demand and revenue impacts of new telephone rate structures; developed and evaluated damage studies used in major telecommunications antitrust actions; analyzed the market potential for cellular radio; evaluated the investment and marketing programs of telephone companies; and developed a demand model for analyzing the market potential for alternative employee health care plans, including health maintenance organizations.

Dr. Tardiff has published extensively in the transportation literature. He has presented and published papers on the telecommunications industry. These papers address the issues of pricing and costing policies for emerging competition in telecommunications markets; evaluating and forecasting the impacts of telephone rate plans such as local measured service; analyzing the markets for new telecommunications products and services; and local competition and the bypass issue.

EDUCATION

UNIVERSITY OF CALIFORNIA, IRVINE
Ph.D., Social Sciences, 1974

CALIFORNIA INSTITUTE OF TECHNOLOGY
B.S., Mathematics, 1971

EMPLOYMENT

NATIONAL ECONOMIC RESEARCH ASSOCIATES, INC.

1992 Vice President. Works on cases, mainly legal and regulatory, on issues of pricing policy, assessing demand for new and existing products and services, and economic damages. This work involves studies, often involving econometric demand analysis methods, for telecommunications, utilities and other clients. Specific areas have included: assessment of competition in the telecommunications industry; analysis of alternative approaches for regulating telephone utilities; evaluation of the benefits from telecommunication products and services; analyzing the demand for local services, toll, and carrier access; evaluation of the prudence of telephone company investments; damage studies for telecommunications antitrust cases; evaluation of methods for environmental damage assessment; and analysis of energy conservation /programs.

1984-1992 Senior Consultant

CHARLES RIVER ASSOCIATES, INC.--Boston, Massachusetts

1979-1984 Director of Marketing Research. Managed program to apply econometric customer demand models to marketing research problems in telecommunications, electric utilities, transportation and other industries.

Senior Research Associate. Performed studies on urban transportation, freight transportation, energy and telecommunications issues.

UNIVERSITY OF CALIFORNIA, DAVIS--Davis, California

1974-1979 Assistant Professor, Department of Civil Engineering and Division of Environmental Studies. Taught undergraduate and graduate course in transportation and environmental policy and quantitative research methods; conducted research on passenger transportation demand, (including econometric issues).

FELLOWSHIPS, GRANTS, AWARDS

First Place, Dissertation Contest of the Transportation Science
Section of the Operations Research Society of America.

NSF Research Initiation Grant (Engineering Division), 1976-1978.

NSF Grant for Improving Doctoral Dissertation Research in the Social Sciences,
1973-1974.

NSF Predoctoral Fellowship, 1972-1974.

Public Health Service Traineeship, 1971-1972.

AFFILIATIONS

American Economic Association
International Telecommunications Society

TESTIMONY

California Public Utilities Commission, on behalf of Pacific Bell, "Evaluation of MCI's Universal Service Funding Proposal," March 10, 1995.

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"Economic Evaluation of OIR/OII on Open Access and Network Architecture Development: Reply Comments," prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, March 31, 1994 (with Richard D. Emmerson).

"Declaration of Timothy J. Tardiff on Pacific Bell's Productivity Under Price Caps," prepared for filing with the Federal Communications Commission, on behalf of Pacific Bell, February 28, 1994.

"Regulation of Mobile and Wireless Telecommunications: Economic Issues," prepared for filing with the California Public Utilities Commission on behalf of Pacific Bell, February 25, 1994

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Timothy J. Tardiff

- 6 -

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Expert Witness on State Transportation Energy Forecasting, California Energy Commission, Sacramento, September 1980.

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Quantifying the Handicaps of Unequal Access. (Confidential) Prepared for Japan Telecom, January 1994.

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